

Patuxent Wildlife Research Center

“Oil and Birds: Insights from Research at the USGS Patuxent Wildlife Research Center”

Research staff at the USGS Patuxent Wildlife Research Center began studying the effects of crude oil and petroleum products on birds in the late 1970's under a grant from the U.S. Environmental Protection Agency. Over 80 scientific papers were published from this work, and many of the things learned are directly applicable to anticipating effects of the current release of crude oil from the off shore drilling rig that was destroyed in the Gulf of Mexico.

Q: What happens to crude oil after it is accidentally released from an offshore well?

A: All crude oils are not the same. Some are heavy and move below the surface or along the bottom of a body of water. Others float on the surface, where wave action mixes the oil and water into an emulsion. Oil remaining on the surface eventually forms tar balls which may drift ashore or sink to the bottom. Weathering of crude oil begins to take place over time.



Q: What does the term “weathering of oil” mean and does weathered oil have the same toxicity to birds?

A: Once released into the environment, the chemical composition of a crude oil begins to change, and this change is called weathering. Crude oils begin to change their composition upon exposure to water, air, and sunlight. Low molecular weight compounds evaporate readily, and a small amount (usually less than 5%) of the oil dissolves in the water column. There is also conversion of some components to oxidized compounds. Microbes begin to metabolize the structurally simple hydrocarbons and non-hydrocarbons components and can eventually degrade about 40-80% of a crude oil. When weathered oil gets on bird eggs, it tends to be less toxic to avian embryos than are unweathered oils.



Q: Do various oils differ in their toxicity?

A: Crude oils are complex mixtures of thousands of hydrocarbons and non-hydrocarbon compounds. Crude oils, and their refined oil products, can vary greatly in their composition and toxicity.

Q: How do birds become exposed to oil?

A: All aquatic species of birds, as well as upland species nesting in or near marshes have the potential to be exposed, but seabirds are most at risk. The earliest reports of lethal effects on seabirds date back to 1910. The most obvious route of exposure comes from birds swimming in water containing an oil slick. These slicks can vary from as thin as a few micrometers to several centimeters. Birds can ingest oil when they preen their feathers, drink water, or eat food containing oil. Another route of exposure is inhalation of fumes off an oil slick.



Q: What are the effects of oil on birds?

A: The most visible effect is when the plumage of birds becomes oiled, often leading to death from hypothermia or drowning. In addition to the matting down of feathers, indirect effects on birds include damage to vegetation that can persist for years and reductions in food items such as invertebrates. Even efforts to clean up oil spills can alter habitats and reduce bird use. Ingestion of oil is seldom lethal, but there can be sublethal effects that make a bird more vulnerable to starvation, disease, or predation. These sublethal effects include gastrointestinal irritation, pneumonia, impaired osmoregulation, suppression of the immune system, hormonal imbalance, and abnormal behavior.



Q: What are the effects of oil on bird eggs?

A: Avian embryos, especially very young ones, are very sensitive to crude oil and refined petroleum products when these substances get on egg shells. Oil can get deposited on eggs when adults build nests with oil-contaminated materials and when adults get oil on their feathers and carry it back to the nest. Embryos die not because the oil covers the shell and suffocates the egg, but because some of the oil penetrates through the shell and is toxic to the embryo. Very small quantities of some crude oils can kill embryos. In one study, when only 5 microliters of South Louisiana crude oil was placed on the shell of mallard eggs containing 2-day-old embryos, it killed 100% of the embryos. To place a number like 5 microliters in perspective, one drop of water equals about 50 microliters, so only a fraction of a drop of crude oil on the eggshell can kill an embryo. Chicks that do hatch can have their health impacted by any oil they ingest. For example in one study, mallard ducklings fed South Louisiana crude oil grew slower than controls.



Q: How long after an oil spill are birds and other wildlife at risk?

A: Oil usually persists in the water column for less than six months. It is the oil that comes ashore that lasts longer. On cobble beaches, sheltered tidal flats, and wetlands some fractions of the oil can persist for decades. Many weeks after an oil spill has washed ashore, birds can be oiled and die as oil is resuspended off marsh surfaces.

Q: Do the compounds making up oil accumulate or biomagnify in birds and other animals?

A: Animals differ in their ability to metabolize and excrete various fractions of crude oil. For example, bivalve mollusks accumulate the hydrocarbon fractions readily, whereas fish have more highly developed pathways for eliminating crude oil hydrocarbons and accumulate little. Birds also can metabolize ingested oil. Although some accumulation of the various compounds in crude oils does occur in animals, the kind of food chain biomagnification that makes some pollutants very dangerous does not occur to the same degree with oil.

Q: What are oil dispersants and are they toxic to birds?

A: Dispersants are chemicals that break up oil into very small droplets and disperse the droplets throughout the water column. Although dispersants are beneficial in that they remove oil from the water surface, prevent tar balls from forming, and make it harder for oil to stick to plants, there are some disadvantages. Dispersants increase the amount of oil in the water column where fish and invertebrates can be exposed and poisoned, may help oil penetrate deeper into beaches, and dispersants can be toxic to birds and eggs by themselves.

References:

http://www.pwrc.usgs.gov/oilinla/PWRC_oil_papers.html